

IMPROVING THE RECEIVING OF TOBACCO AT AUCTION WAREHOUSES

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PREFACE

This study, conducted during 1967 and 1968 with the cooperation and support of the Department of Biological and Agricultural Engineering, North Carolina Agricultural Experiment Station, Raleigh, N.C., is part of a broad research study to improve the methods and equipment for handling tobacco in auction warehouses. Its purpose is to reduce labor requirements for receiving tobacco from the farm and at the same time speed up receiving operations at auction warehouses so that producers delivering the tobacco need not spend a long time waiting for their trucks to be unloaded.

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By Albert H. Graves¹

Conventional methods for receiving tobacco at auction warehouses are compared to an improved system which uses gravity conveyors and a forklift truck for handling the tobacco. The improved system doubles the cost for equipment, but halves labor costs. The system provides an overall saving of \$56.56 per 1,000 sheets of tobacco received.

INTRODUCTION

For many years warehouse employees and tobacco growers have pushed hand trucks loaded with tobacco from the farm truck to the warehouse scale and then across the warehouse floor to the sales area of tobacco auction markets. The procedure involves many miles of walking. As wages for common labor used at the warehouse increased, it became apparent that an improved method for receiving and handling tobacco at the warehouse was needed. Furthermore, with the shortage of farm labor, growers found it too costly to wait hours on end to unload tobacco at the auction warehouses, during which time the workers on their farms were without supervision.

In developing an efficient receiving system, prevailing practices were first evaluated. Then improvements were designed and tested under commercial operating conditions at Carolina Warehouse, Fuquay, North Carolina, and Centre Brick Warehouse, Wilson, North Carolina.

This report describes and evaluates the conventional receiving system and compares it with the newly designed, improved system.

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DESCRIPTION AND EVALUATION OF CONVENTIONAL RECEIVING OPERATIONS

Handling of tobacco delivered in sheets² (fig. 1) varies considerably between warehouses. Most warehouses unload the trucks in sequence of their arrival at the warehouse. The tobacco is moved from the grower's truck to the scale, and then to a sales floor location, generally specified by the grower.

Moving tobacco by hand requires pushing a handtruck loaded with one sheet of tobacco. For a complete sale, workers frequently walk as far as 76 miles flooring (placing on sales floor) tobacco³.

Figure 2 shows the flow from truck to floor in a conventional tobacco auction warehouse. The approximate direction of product flow is identified, as well as the distances between operations prevailing in most Northern flue-cured area warehouses.

Labor Requirements for Conventional Receiving Operations

A typical conventional receiving operation involves an unloading crew of four men (fig. 1); two men in the truck drag sheets to the rear of the truck, and two men on the warehouse floor place the sheets in a basket on a tobacco handtruck (fig. 3).

After the unloading crew places the sheet of tobacco in the basket, one worker pushes the

² A sheet of tobacco is approximately 200 pounds of untied tobacco packed in an 8- by 8-ft. sheet of burlap.

³ Davis, Roy B., Jr. A Conveyor System for Flue-Cured Tobacco Auction Centers. Presented at 22nd Tobacco Workers Conference, July, 1968.

handtruck to the scale where the tobacco is weighed (fig. 4), and then to the sales floor (fig. 5) where it is unloaded (fig. 6) and placed in a square marked on the warehouse floor.

The warehouse employee then returns with the handtruck to the receiving area, where he waits for another sheet of tobacco to be unloaded from the grower's truck.



FIGURE 1.—Tobacco being received at an auction warehouse. SALES FLOOR house.

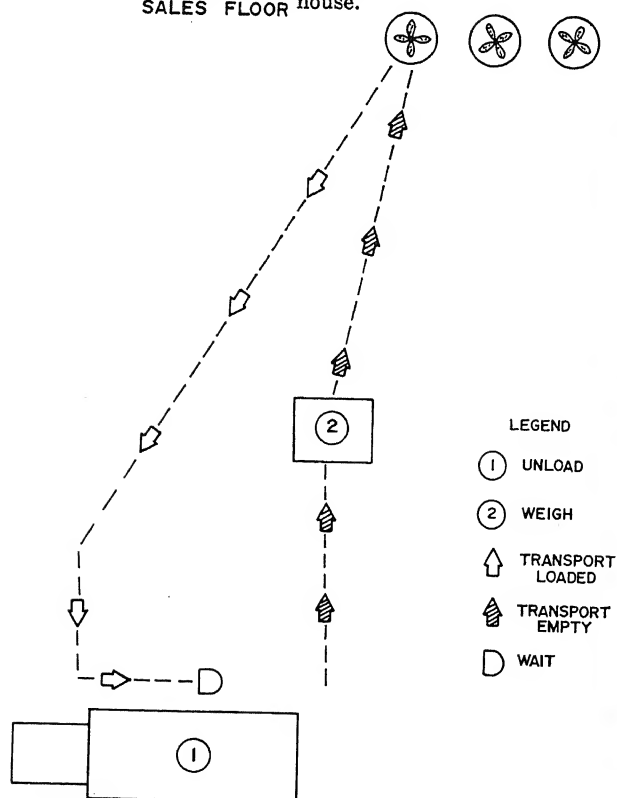


FIGURE 2.—Flow pattern in the conventional receiving area of a typical tobacco auction warehouse.

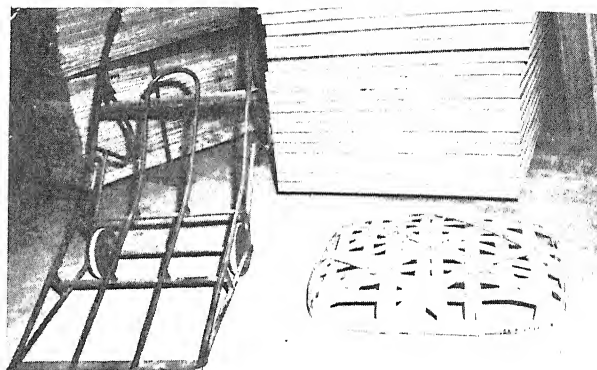


FIGURE 3.—A typical handtruck and basket used in tobacco auction warehouses.

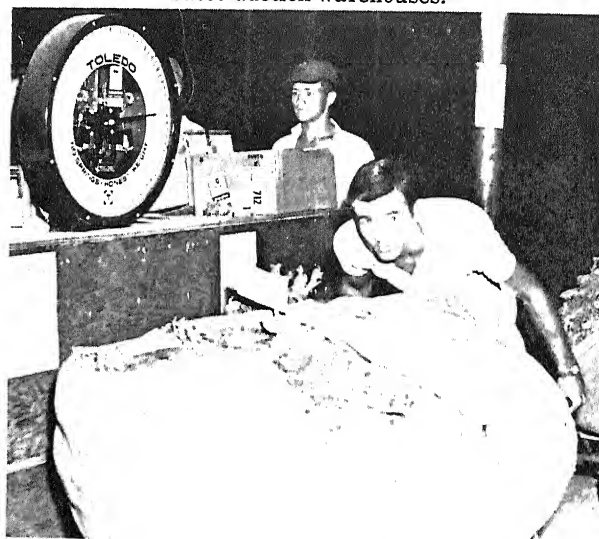


FIGURE 4.—A worker about to push a loaded handtruck from scale to sales floor.



FIGURE 5.—Time required to manually push a handtruck a specific distance.

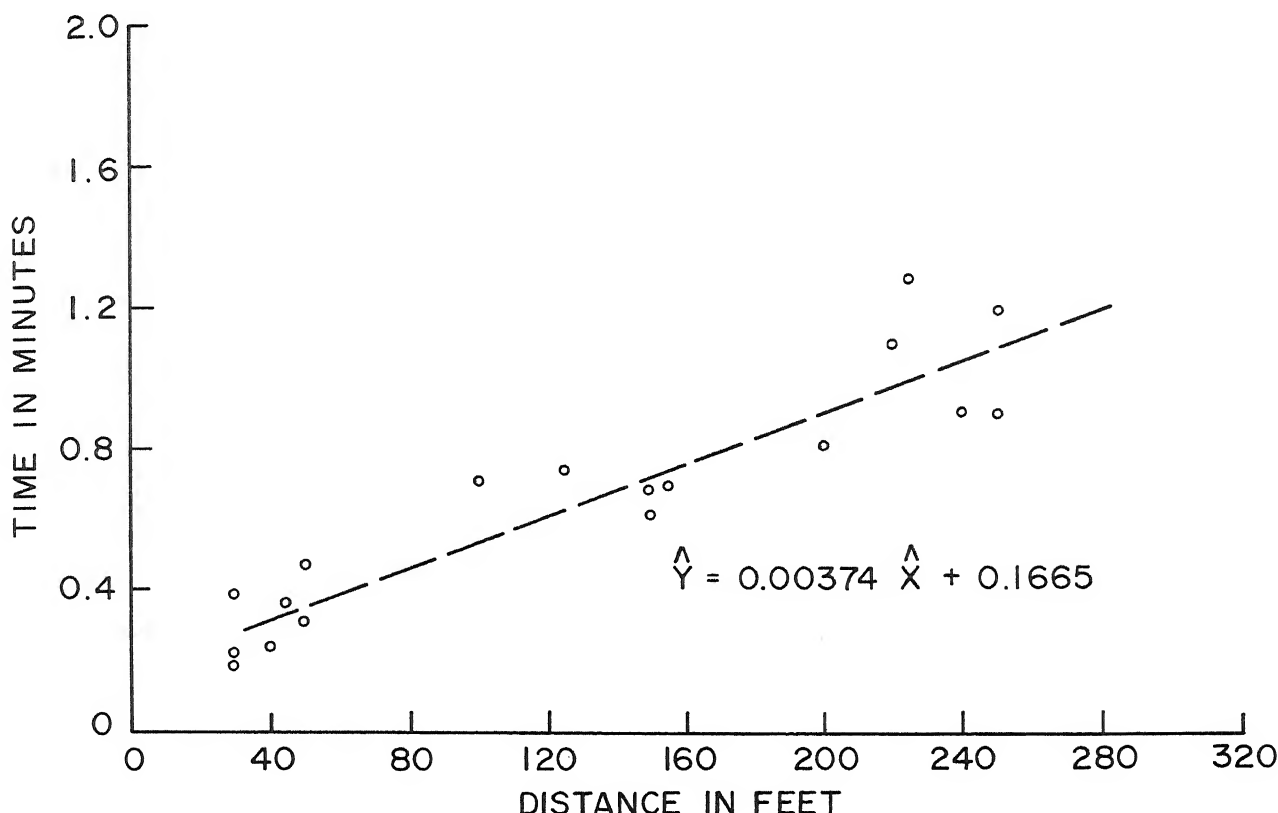


FIGURE 6.—Worker unloads basket of tobacco onto sales floor as another worker (hookman) gets ready to position it within a square on the floor.

The time breakdown for an 18-man crew to unload three sheets of tobacco using handtrucks and baskets is shown in the following tabulation:

<i>Productive labor</i> ¹	
	<i>Man-minutes</i>
Unload sheets of tobacco (4-man crew)	5.16
Fill out headings on tobacco sale bill and scale tickets (weighmaster) .....	.39
Weigh 3 baskets of tobacco and record weights (weighmaster) .....	.90
Push hand truck loads of tobacco to scales to sales floor and unload, and return to truck (12-man crew)	8.01
Position 3 baskets on sales floor and untie sheets as time permits (hook man)	1.17
Total productive labor	15.75
<i>Unproductive labor</i>	
Employees with hand trucks wait (12-man crew)	7.47
Total labor	23.22

¹ Allowances for fatigue and personal time were 5% each, except for unloading, where 25% was allowed, and pushing hand trucks, where 10% was allowed. Elapsed minutes were 1.29.

The largest part of the unproductive labor is accounted for when workers are required to wait

(12-41 minutes) their turn at the grower's truck, at the scale during weighing, and for selection of a spot on the sale floor. This is also lost at irregular intervals when members of the unloading crew rest without regard for the following or preceding operation, or other members of the crew.

Equipment Requirements for Conventional Receiving Operations

The conventional receiving operation requires a minimum of equipment. Most warehouses use a standard platform scale, handtrucks and baskets. The handtrucks were designed (fig. 3) to transport and unload one basket of tobacco. Fifty handtrucks and 1,750 baskets are the equipment requirements assumed in this report.

DESIGNING, TESTING, AND EVALUATING AN IMPROVED RECEIVING OPERATION

In designing an improved receiving system, the objective was to enable the warehousemen to improve service to the growers by modifying

the tobacco handling operation in the warehouse so as to utilize workers' time more effectively while minimizing equipment costs.

In evaluating the conventional receiving system, it was found that the major bottleneck involved the weighing operation. At some warehouses, tobacco from as many as five growers was being unloaded at the same time, which required truck unloaders to wait for the scale to be cleared.

The first step in speeding up the operation was unloading only one truck at a time rather than all four at once. To reduce handtruck labor and to speed up delivery of incoming tobacco to the scale, a gravity roller conveyor was installed between the truck receiving platform and scale. Thus, the scale was provided with a constant supply of tobacco. Time lost at the scale was reduced also by installing conveyor sections on the scale to permit quick on and off movement of baskets (fig. 7). To avoid a buildup of weighed tobacco at the unloading end, a standard forklift truck equipped with a section of roller conveyor long enough to hold 3 sheets of tobacco (fig. 8) was used to move tobacco from the gravity conveyor system to sales floor.

With these additions to the system, congestion at the scale was eliminated and transport time to the sales area was reduced. Placing tobacco on the sales floor by forklift eliminated

much of the manual labor formerly required in the receiving operation.⁴ A forklift can carry three baskets of tobacco 146 feet across a warehouse floor and return to the pickup station in 1 minute at an average speed of 3.32 miles per hour. Although one worker can push a loaded handtruck to the sales floor at the same speed in the same amount of time, he is handling only one basket at a time compared with the forklift's three. As the worker tires and tends to slow down, the forklift can continue at the same speed indefinitely, and has the additional advantage of becoming more efficient as transport distances increase. Two forklifts, carrying 3 baskets of tobacco each, are approximately equivalent to 12 warehouse employees pushing handtrucks.

Labor Requirements for Improved Receiving Operations

The crew size used in the improved receiving operation is reduced to about one-half the number used for the conventional operation. Their job requirements are different, too.

The ticket maker obtains the marketing card (ASCS salecard) from the grower and fills out the headings on the tobacco sale bill, and the heading information on scale tickets.

⁴ Graves, Albert H. 1969. "Mechanized receiving of untied tobacco delivered in sheets to auction warehouses." *Tobacco Science* 13:85-89.

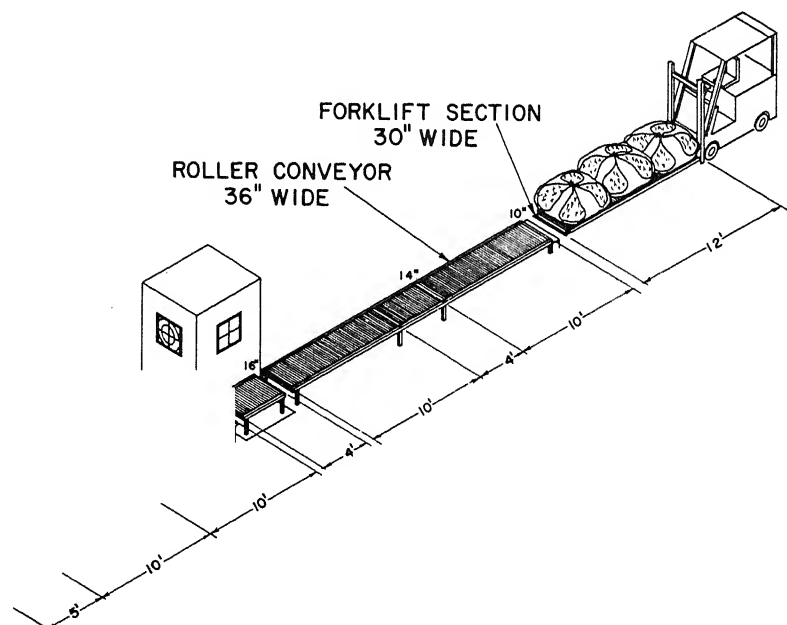
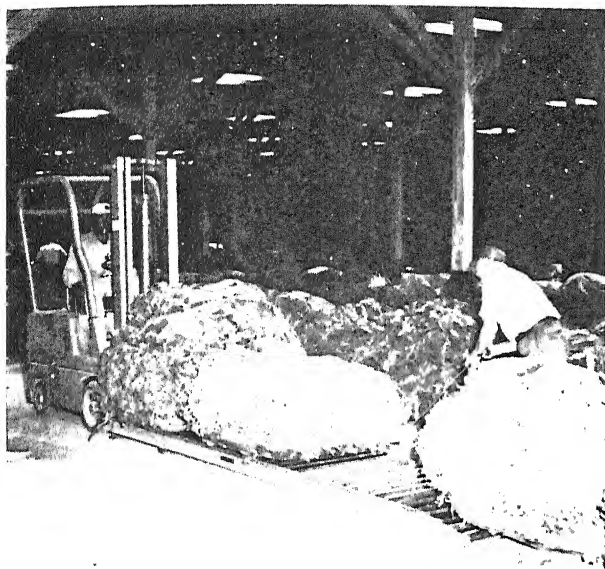


FIGURE 7.—Gravity conveyor receiving system for auction warehouses.



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FIGURE 8.—Forklift with conveyor section mounted in front for carrying 3 sheets of tobacco from scale to sales floor.

The two-man unloading crew maintains a constant supply of empty baskets and promptly places sheets of tobacco into baskets on the receiving conveyor. Each basket is then pushed toward the scale so that the weighmaster is provided with a continuous flow of tobacco. Speed and efficiency in this operation is gained by having each worker perform the same operations for each truck.

The weighmaster's helper is responsible for moving baskets of tobacco from the receiving conveyor onto the scale platform; furnishing the weighmaster with the marketing card, tobacco sale bills, and scale tickets as required; and moving weighed and tagged tobacco from holding conveyors to forklift as necessary.

The weighmaster weighs baskets of tobacco, then records weight on scale ticket or tobacco sale bill while the basket is leaving the scale and another one is being moved in position.

The forklift driver aligns the conveyor on his forklift truck with the conveyor holding weighed baskets of tobacco. Three baskets are rolled onto the forklift conveyor by the weighmaster's helper. The driver raises the fork, drives to the sales floor, unloads the baskets in the assigned positions, and returns to the holding conveyor for another load.

The floorman (hookman) aligns the baskets

delivered to their assigned location by the forklift in neat even rows, and then unties sheets as time permits until the next forklift load arrives.

The time breakdown for a crew of 10 men to receive 3 sheets of tobacco using baskets, gravity conveyors, and forklift trucks is shown in the following tabulation (allowances were 10% for all except unloading, where 25% was used).

<i>Productive labor</i>	<i>Man-minutes</i>
Unload sheets of tobacco from farm truck into baskets on gravity roller conveyor (4-man crew)	3.44
Push tobacco on scale and onto forklift truck (weighmaster's helper) .....	.55
Fill out headings on floor sheet and scale tickets (ticketmaker) .....	.59
Weigh tobacco and record weight on scale ticket and on tobacco sale bill (weighmaster) .....	.36
Pick up 3 sheets of tobacco on forklift truck, drive to sales area, unload and return to receiving area (forklift truck driver)	1.18
Place three baskets on sales floor and untie sheets as time permits (hookman)	1.18
Total productive labor	7.30
<i>Unproductive labor</i>	
Ticket maker waits to fill out floor sheets and scale tickets .....	.59
Weighmaster waits for helper to push baskets of tobacco onto scale .....	.55
Weighmaster waits for sheets .....	.27
Weighmaster's helper waits for tobacco to be weighed .....	.36
Weighmaster's helper waits for sheets .....	.27
Four-man unloading crew waits for truck to be positioned	1.28
Forklift driver waits	1.18
Total unproductive labor	4.50
Total labor	11.80
Elapsed minutes were	1.18

Equipment Requirements for Improved Receiving Operations

The improved receiving system illustrated in figure 7 mechanizes materials handling by means of a combination of gravity roller conveyor and forklift truck. It requires 54 feet of 36-inch-wide roller conveyor, 14 conveyor support standards, two 36-inch roller-conveyor right angle turns, two 12-foot sections of 30-inch roller conveyor (for forklift trucks) and rental of two forklift trucks. As in the conventional system, the improved system requires 1,750 tobacco baskets and a platform scale. The scale platform, however, must be equipped with a 4-foot length of 36-inch-wide roller conveyor.

COMPARISON OF COSTS FOR CONVENTIONAL VS IMPROVED RECEIVING OPERATIONS

A comparison of costs for the two systems (table 1) shows that the equipment cost (\$89 per 1,000 sheets) for the improved system is over twice that of the conventional system (\$43 per 1,000 sheets). However, man-hour requirements were about 50% less for the improved system (65.60 MH per 1,000 sheets) than for the conventional system (129.06 MH per 1,000 sheets).

When labor and equipment costs for each system are combined, the improved system is shown to reduce handling costs \$56.56 per 1,000 sheets of tobacco received. Projected over a 5,000,000-pound season, handling costs are reduced by \$1,524 (\$24 more than the \$1,500 cost of the new system. Tables 2-5 show detailed breakdowns of labor and equipment costs for the two systems.

In addition to reducing handling costs, the gravity conveyor system significantly reduces total unloading time for the growers delivering tobacco to the warehouse.

TABLE 1.—*Crew size, time requirements, and equipment and labor costs for receiving 1,000 sheets of tobacco by the conventional and improved methods*

Method	No. in crew	Elapsed time (hr.)	Labor and equipment required		Labor and equipment costs (\$)		
			Labor (man-hr)	Equipment (machine-hr)	Labor	Equipment	Total
Conventional Method	18	7.17	129.06	.....	226.27	43.00	269.27
Improved Method	10	6.56	65.60	13.12	123.71	89.00	212.71
Savings	8	.61	63.40	...	...	...	56.56

TABLE 2.—*Labor costs for receiving 1,000 sheets of tobacco using hand trucks and baskets (conventional method)*

Operation	No. in crew	Elapsed time (hr)	Labor man-hr	Cost (\$)
Unloading				
Place sheets of tobacco in baskets on hand trucks	4	7.17	28.68	¹ 45.8
Trucking				
Push hand truck with sheet of tobacco to scale, to sales floor, return to truck and wait as required	12	7.17	86.04	¹ 137.66
Weighing				
Fill out headings on tobacco sale bill, scale tickets and weigh tobacco	1	7.17	7.17	² 31.25
Flooring, positioning, and untieing	1	7.17	7.17	¹ 11.47
Total			129.06	226.27

¹ Labor rate @ \$1.60 per hr.

² Weighmasters pay rate = \$125 per week ÷ 4 days/wk × 7.17 hr/day = \$4.36/hr.

TABLE 3.—*Labor costs for receiving 1,000 sheets of tobacco using gravity conveyors, baskets and forklifts. (improved method)*

Operation	No. in crew	Elapsed time (hr)	Labor (man-hr)	Cost ¹
Unloading				
Place sheets of tobacco in baskets on gravity roller conveyor and wait as required	4	6.56	26.24	\$ 39.98
Weighing				
Make up scale tickets and tobacco sale bills, position sheets on scale conveyor, wait as required and weigh tobacco ..	3	6.56	19.68	52.24
Flooring, positioning and untying	3	6.56	19.68	31.49
Total			65.60	123.71

¹ Common labor rate \$1.60/hr; weighmaster's rate \$4.36/hr (see table 2).

TABLE 4.—*Conventional System: Equipment*

Equipment	Initial cost ¹	Expected life (years)
50 hand trucks	\$2,500	10
1 scale	2,500	20
1,750 baskets ⁷	3,500	12.5

¹ 1968 prices, including installation. ² 8 percent of initial cost. ³ 24 per kilowatt.
⁷ Baskets are charged to receiving operation only.

⁸ Baskets are prorated between receiving, selling, loadout, and other company operations (hauling, green pricing or redrying).

TABLE 5.—*Ownership and operating costs for receiving 5,000,000 pounds of flue-cured tobacco at auction warehouses*

Ownership cost			Operating cost			Total annual cost	Cost per pound (cent)	Cost per sheet (cents) ⁶	Cost per 1,000 pounds (cents)
Interest ²	Insurance ³	Taxes ⁴	Total	Power ⁵	Maintenance				
\$100	\$50	\$25	\$425	---	\$15	\$440	0.0088	1.4	8.8
100	50	25	300	\$5	50	355	.00710	1.2	7.1
140	70	35	525	---	---	525	.01050	1.7	10.5

average investment (50 percent of initial cost). ³ 2 percent of initial cost.
⁶ 164 pounds of tobacco per sheet.

to extreme day to day variations in use time for selling, loadout, hauling, green pricing and redrying operations.

TABLE 5.—*Improved System: Equipment ownership and operating costs for receiving 5,000,000 pounds of flue-cured tobacco at auction warehouses*

Equipment	Initial cost ¹	Expected life (years)	Depreciation	Interest ²	Insurance ³	Taxes ⁴	Total	Power ⁵	Maintenance	Total annual cost	Cost per pound (cent)	Cost per sheet (cents) ⁶	Cost per 1,000 pounds (cents)
1 gravity conveyor ⁷	\$1,500	10	\$150	\$ 60	\$30	\$15	\$ 255	---	\$10	\$ 265	0.00530	.9	5.3
1 scale (with roller platform)	2,500	20	125	100	50	25	300	\$ 5	50	355	.00710	1.2	7.1
1,750 baskets ⁸	3,500	12.5	280	140	70	35	525	---	---	525	.01050	1.7	10.5
2 rental forklift trucks	---	---	---	---	---	---	1,250	312	---	1,562	.03124	5.1	31.2

¹ 1968 prices, including installation. ² 8 percent of average investment (computed at 50 percent). ³ 2 percent of initial investment.
⁴ 1 percent of initial investment. ⁵ 2¢ per kw-h. ⁶ 164 pounds of tobacco per sheet.

⁷ 50 feet of 36-inch roller conveyor, two 36-inch right angle roller conveyor turns, 14 conveyor support standards.

⁸ Baskets are charged to receiving operations only due to extreme day to day variations in use time for selling, loadout, hauling, green pricing and redrying operations.

⁹ Baskets are prorated between receiving, selling, loadout, and other company operations (hauling, green pricing or redrying).